diminutive pedal muscle upon the inner face of the imperfectly reproduced right valve, which was deformed owing to the lack of support of the right mantle, because of the removal of the original right valve. As a consequence the right mantle was rolled up at the edge, and this deformation of the mantle was reflected in the attempted regeneration of the lost right valve. The pigment developed during exposure to light in the mantle and gills in oysters with the right valve removed which were kept alive in the aquaria at Sea Isle City by Prof. Schiedt was wholly confined to the epidermis as it normally is at the mantle-border in the unmutilated animal in nature. The inference to be drawn from these facts is that the development of pigment in the mantle and gills was wholly and directly due to the abnormal and general stimulus of light over the exposed surface of the mantle and gills, due to removal of the right valve, and that the mantle-border, the only pigmented portion of the animal, is pigmented because it is the only portion of the animal which is normally and constantly subjected to the stimulus of light.

Oysters which had the right valve removed were found to live perfectly well in the marine aquaria at Sea Isle, and would no doubt have survived till now had Prof. Schiedt been able to continue his experiments there. The most remarkable results obtained as a consequence of these experiments were that the adductor muscle was soon attacked by bacteria and destroyed by putrefaction, while the great ganglion underlying it remained uninjured. The pericardiac cavity was also torn open, exposing the heart completely, in some instances. In these cases the heart continued to beat and propel the blood through the other organs of the body as if nothing untoward had happened. The maximum rate of pulsation of the heart noted was 52 per minute, which is much greater than the rate hitherto reported.

The anus was also retracted into a new and more anterior position, owing to the loss of support which it had suffered in consequence of the sloughing away of the adductor muscle. Whether the adductor muscle thus sloughed away would ultimately be reproduced was not determined, since the experiments were interrupted before the animals had time to present evidence of such regeneration of the lost muscles.

These experiments open up a most suggestive line of investigation upon other univalve and bivalve mollusca, viz.: experimental researches as to the effect of removing the valves and exposing them to the light. Many other species, both marine and fresh-water, might obviously be experimented upon with very instructive results as respects the questions raised by the present communication.—*Proc. Acad. Nat. Sci. Philad.* Nov. 15, 1892.

The Hermaphroditism and Viviparity of the Oysters of the North-west coast of the United States.

Prof. J. A. Ryder also reported on behalf of Prof. R. C. Schiedt, of Franklin and Marshall College, Lancaster, Pa., the latter's discovery of the fact that the oysters native to the north-west coast

of the United States are hermaphrodite and viviparous. Specimens from the coast of Oregon and Washington show that the same condition exists in the reproductive follicles as in those of *Ostrea edulis* of Europe. The presence of eggs and of spermatoblasts and spermatozoa in the same follicles is the invariable rule. The ova, like those of *O. edulis*, are much larger than those of *O. virginica*, though perhaps not quite so large as the former. The embryos are fertilized in the gill and mantle cavities, where they undergo development.

These north-west-coast oysters also resemble the oysters of Europe in that they are small and have little or no indication of purple pigment on the impression or point of insertion of the adductor muscle, which is so conspicuous a feature in *Ostrea virginica* of our eastern coast.—*Proc. Acad. Nat. Sci. Philad.* Nov. 15, 1892.

Large Variations in the Metamorphosis of the same Species.

An elaborate memoir entitled, "The Embryology and Metamorphosis of the Macroura," by W. K. Brooks and F. H. Herriek, makes 140 pages quarto of the fifth volume of the Memoirs of the U. S. National Academy of Sciences, and is illustrated by 57 plates. The species microscopically investigated and here reported upon are of the genera *Gonodactylus*, *Alpheus*, and *Stenopus*. The authors mention, in the introductory pages, as one remarkable result of their study of the genus *Alpheus*, the discovery that while the larval stages of different species are similar, the individuals of a single species sometimes differ more from each other as regards their metamorphoses than the individuals of two very distinct species, and make on this point the following remarks:—

This phenomenon has been observed by us and carefully studied in two species—*Alpheus heterochelis* and *Alpheus Saulcyi*—and it is described in detail, with ample illustrations, in the chapter on the metamorphosis of *Alpheus*. In the case of the first species the difference seems to be geographical, for while all the individuals which live in the same locality pass through the same series of larval stages, the life-history of those which are found at Key West is very different from that of those which live on the coast of North Carolina, while those which we studied in the Bahama Islands present still another life-history. In the case of the second species —*Alpheus Saulcyi*—the difference stands in direct relation to the conditions of life. The individuals of this species inhabit the tubes and chambers of two species of sponges which are often found growing on the same reef, and the metamorphosis of those which live in one of these sponges is sometimes different from that of those which inhabit the other. In this species the adults also are different from each other, but as we found a perfect series of transitional forms there is no good reason for regarding them as specifically distinct; and in the case of the other species—*Alpheus heterochelis*—we were unable, after the most thorough and minute comparison, to find any difference whatever between adults from North Carolina and those from the Bahama Islands, although their